Saskatchewan Research Council

Annual Report 1990 - 91

92-05579/

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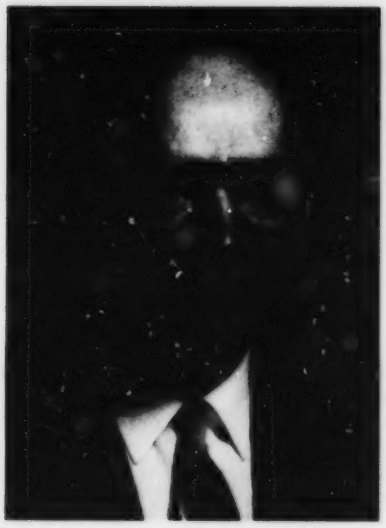
CORPORATE PROFILE

Established in 1947, SRC furthers the economic development and diversification of Saskatchewan by providing unique applied scientific, engineering, and technical services. Over two hundred scientists, engineers, technicians and support staff deliver these services to the resource, manufacturing, agriculture, and business sectors of Saskatchewan.

In 1990-91, SRC worked with over two thousand clients in government, industry and business to carry out its mission: "We are committed to helping the people of Saskatchewan develop a viable economy, with quality jobs and lifestyles. We do this through research, development and transfer of innovative scientific and technological solutions, applications and services."

SRC is a member of the Association of Provincial Research Organizations (APRO).
APRO President 1989-91: Jim Hutch



The Honourable John Penner

LETTER OF TRANSMITTAL

February 1992

To the Honourable Sylvia Fedoruk
Lieutenant Governor of Saskatchewan

May it please your Honour:

The undersigned presents herewith, for your consideration, the report of the Saskatchewan Research Council for the year ended March 31, 1991.

Respectfully submitted,

John Penner
Minister Responsible for the Saskatchewan Research Council

THE RESEARCH COUNCIL ACT

Section 21, in part, directs that:

The Council shall on or before the last day of February in each year submit to the Lieutenant Governor in Council a report of its proceedings and transactions during the next preceding calendar year which report shall contain such particulars as the Lieutenant Governor in Council may prescribe. Every report shall be laid before the Legislative Assembly if then in session, or if not in session, within fifteen days after the opening of the next session.

Saskatchewan Research Council Board of Directors

(as of March 31, 1991)

Gordon C. Birney
Chairman, SRC
Partner, Birney & Smith
Chartered Accountants
Saskatoon

John Cross
Vice Chairman, SRC
President
Philom Bios Inc.
Saskatoon

Jim Hutch
Secretary, SRC
President, SRC
Saskatoon

Hon. Rick Swenson
Minister Responsible for SRC
Regina

Dr. Cam Blachford
Associate Vice President &
Dean, Faculty of Graduate
Studies and Research
University of Regina
Regina

Dorlas Bratvold
Teacher
Vanguard

Oscar Hanson
President
SaskEnergy Corporation
Regina

Denise Kobayashi-Keith
Structural Engineer
Reid Crowther & Partners
Regina

Val Kononoff
Vice President, Saskatchewan
Association of Rural
Municipalities, Arelee

Curtis F. Kunkel
President
ALTO Construction
Services Ltd.
Esterhazy

Thomas Mann
Farmer
Drinkwater

J.G. (Jack) Manns
Associate Vice President,
Research & Dean, College of
Graduate Studies & Research
University of Saskatchewan
Saskatoon

Peter N. Nikiforuk
Dean, College of Engineering
University of Saskatchewan
Saskatoon

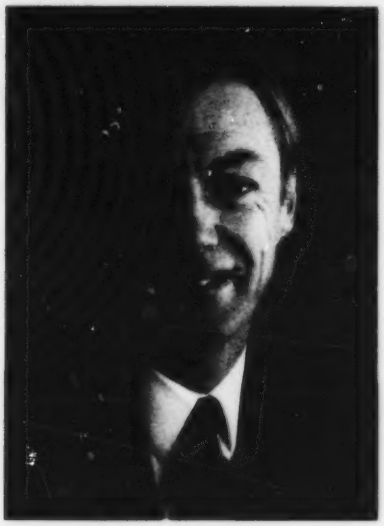
Harley D. Olsen
Executive Coordinator
World Centre for Agricultural
Science and Development
Saskatoon

Diana S. Rak
Marketing Manager
Peat Marwick Consulting Group
Saskatoon

Gavin Semple
President & General Manager
Brandt Industries Ltd.
Regina

Carol Skelton
Farmer
Harris

W.L. Whelan
Manager, Saskatchewan Div.
Canadian Petroleum Association
Regina



Gordon Birney,
Chairman of the Board of Directors

CHAIRMAN'S MESSAGE

The performance of the Saskatchewan Research Council can best be defined as excellent and rewarding. An excellent performance was achieved despite a year which was full of adversities. Saskatchewan, Canada, and many of the industrialized countries of the world suffered through difficult economic recessionary conditions.

The symptoms of the recession were very apparent in our province in the form of high unemployment levels, loss of population, a record number of business failures and many foreclosures associated with the province's largest industry, agriculture, resulting in adversely affecting the family structure.

Now is the time for restructuring and rebuilding.

The building blocks are being designed and defined. Research and scientific development and implementation will serve as a catalyst for a betterment in our economy. Improved standards of education and employee training in preparation for meeting the new challenges will also be an integral part of our changing econ-

Jim Hutch, President

PRESIDENT'S MESSAGE

As the financial information shows, SRC achieved a modest surplus. We did this in spite of a 2% reduction in our operating grant. Our contract revenue increased nearly 6% during what was considered a difficult year, economically.

Credit for SRC's financial success goes to the adaptability and dedicated service of our people. SRC's depth of expertise includes: 21 Ph.D.s, 20 Masters degrees, 51 Bachelor degrees and 47 Technical Diplomas, backed by highly qualified and experienced support staff. These qualifications are the foundation we build on as we accept the challenge of being at the leading edge. Staff development is seen as part of the daily process to help our clients and the

omy, coupled with a vision to foresee and define the opportunities associated with the economical changes. These changes will not only be experienced in Saskatchewan, but also nationally and globally.

SRC is in a position to provide a leading role in the recovery process through its involvement in timely research and development activities, its access to new technologies by acting in collaboration with the Association of Provincial Research Organizations, universities and government agencies.

The current research and development activities of SRC are very much in tune with the needs of the day. They include many exciting projects, such as:

- New product and process development
- Enhancement of heavy oil recovery and improved quality
- Pipeline research and design
- Genetic research for the livestock industry
- Farm equipment design
- Groundwater research and development
- Environmental research and technology transfer addressing issues such as surface water quality and impacts of climatic change
- Air sampling equipment and indoor air testing
- A multiplicity of services to the natural resource industries, in particular the exploration, mining and agricultural industries
- A variety of services associated with other sectors of the economy

SRC has developed a customer service orientation resulting in quality research and service that is timely, appropriate and responsive to market needs. Evidence of this high quality of service is shown by the increased number of projects which SRC is requested to participate in, including many from international sources.

For the support and dedication of the people of SRC, under the excellent leadership of Jim Hutch, in achieving another successful year of operations amidst economic turmoil, your Board of Directors and I sincerely thank you.

Gordon Birney

province address the realities of a changing and competitive international marketplace.

We are working closely with our clients to help them meet their short and long term needs. Industry in Saskatchewan is supported by our work in one of two ways: import substitution or export opportunity. We have helped Saskatchewan businesses put world class products on the market. In addition, our scientists and engineers continue to develop and adapt technologies and value added products that help to diversify the provincial economy.

The real story of SRC's contribution to the province is told in a list of the practical benefits received from our scientific and technological expertise: development and management of our resources and environment, stronger and more competitive businesses, and creation or protection of jobs.

The accomplishments and contributions you see in this report allow us to move forward into the changing and challenging future with confidence. A confidence that is supported by optimism, innovation and determination and strengthened with the help of our partners in industry, education and governments.

Jim Hutch

Staff:
J. Konecsni (M.A.)
L. Kunstmann
C. Tegenkamp

To analyze indoor air quality and possible contaminants, SRC research technologist Jerry Makohon uses a multigas infrared analyzer which can identify 100 chemicals in the air.

Staff:
J. Poon (B.Comm.)
M. Savostianik
M. Gryschuk
C. Hudym

TECHNOLOGY TRANSFER AND BUSINESS DEVELOPMENT BRANCH

Vice President: Ravi Maithel, M.Sc., P.Eng.

TECHNOLOGY TRANSFER

The branch assists business and industry to identify, adapt and transfer appropriate technologies. Viewing technology as a competitive input that can strengthen a company's market position, the branch has developed services to assist clients improve their operations and diversify their product line through appropriate application of technology.

The branch provides knowledge and experience across the spectrum of disciplines required for effective technology transfer. Participation in national and international technology networks provides access to sources of proven technological applications for Saskatchewan industry and assistance to commercialize technologies developed in the province.

BUILDING SCIENCE

The Building Science Division serves the Canadian construction industry with specialized engineering research. Building Science Division staff have been associated with many key developments in the low energy housing field. Building experts conduct energy monitoring, provide air tightness testing of building components and develop computer models of building energy systems. Specialized techniques are used to evaluate building envelope systems in all stages, from design and development through construction and operation. Large or small scale studies of radon and soil gas measurement and control can be performed using a state of the art microcomputer based radon data acquisition system.

Interdisciplinary teams assess the quality of the indoor environment by analyzing and measuring indoor air pollutants and evaluating the performance of ventilation systems. Pollutant emission characteristics of building materials are determined, using small and large chamber tests. An outdoor facility is used for exposure testing of materials and components.

Staff:
Director: D. Figley (Ph.D., P.Eng.)
R. Dumont (Ph.D.)
M. Heskin
J. Makohon
A. Roach
L. Snodgrass (A.Sc.T.)

Highlights

- Completed field work on volatile organic compounds (VOCs) in Saskatoon and Regina houses, as part of a national study on newly constructed houses.
- Initiated development of small and large environmental chambers for evaluating chemical emissions from building materials to contribute towards developing national standards for controlling building material emissions.
- Drafted technical criteria for advanced low energy houses field trials for Canada, to be conducted by the Canadian Home Builders' Association.
- Carried out a comprehensive radon project to mitigate adverse effects on occupants of residential homes.
- Conducted a field study on the soilgas leakage characteristics of a group of new houses to assess proposed measures for the 1990 National Building Code of Canada.

Publications

Measured Energy Consumption of a Group of 99 Low Energy Houses. Dumont, R.S. I-4800-9-A-91

The Instron Universal Tensile/Compression Tester is used to perform physical testing on a variety of building materials, such as metals, plastics and elastomer products, to ensure the materials meet national and international standards.

Product Research Laboratory

The Product Research Laboratory responds to the needs of industry and government agencies for testing and certification of industrial and consumer products. The fully equipped laboratory performs mechanical and physical testing services for Saskatchewan and Canadian industrial clients. Laboratory experts work with clients to develop specialized testing procedures to ensure high standards for Saskatchewan and Canadian made products. The Laboratory operates under a Quality Assurance Program to meet the requirements of ISO Guide 25 "General Requirements for the Technical Competence of Testing Laboratories". All tests performed at the lab meet the criteria and conform to the requirements of national standards agencies.

Highlights

- Conducted specialized small chamber tests to identify and determine rates of volatile emissions from construction materials to ensure the products meet health and safety guidelines or standards.
- Designed and fabricated rock mechanics instrumentation capable of monitoring underground mine stresses and deformations, for use in potash mines.
- Continued triaxial creep testing of potash cores to obtain material property data for potash mines.

Staff:
Head: P. Freimanis (B.Sc., P.Eng.)
D. Jennings
J. Jones (B.A., Inst.Tech.)
B. MacPherson (Commercial Pilot)

Industrial technology advisors delivering the IRAP program, provide technical information, advice and guidance to industry and manufacturing firms throughout Saskatchewan. Primarily designed to assist small and medium size firms in Saskatchewan, the program has been used to improve wild rice production in northern Saskatchewan.

TECHNOLOGY SERVICES

Technology Services delivers services offered under the National Research Council's Industrial Research Assistance Program (IRAP), under a contribution agreement. This national program provides technical information, industrial engineering expertise and access to Canadian and foreign technology to small and medium size firms in Canada. The program also provides financial assistance to Saskatchewan manufacturing and processing firms.

During 1990-91, IRAP offered assistance to 2,950 small and medium size Saskatchewan enterprises by identifying technical problems, developing technical solutions, and implementing appropriate technical solutions. The division also organized and presented seminars on "Production Management for the Medium-size or Smaller Company" and "Basic Metallurgy of Irons and Steels", as well as a number of technical presentations in conjunction with the Society of Manufacturing Engineers.

Technical Advisory Service

- IRAP-C: Personal and confidential on-site technical advisory service handled 1,647 inquiries to assist Saskatchewan firms in defining their technical needs and in identifying opportunities, obtaining technical information and assistance, as well as solving product and production problems.

Financial Assistance in Technical Solutions

- IRAP-H: 40 projects were approved for Saskatchewan firms to employ a student in the technical solution process.
- IRAP-L: Financial assistance was provided to 99 Saskatchewan firms to obtain laboratory services or to employ a consultant or expert to develop or implement a technical solution.
- IRAP-M: 9 Saskatchewan firms received assistance with longer term research and development projects using resources both internal and external to the firm.

Technology Inflow Program (TIP)

- Supported 20 Saskatchewan firms in importing technologies new to Saskatchewan.

Technical Information Services - Patent Office

- Provided 42 in-depth responses to technical inquiries from Saskatchewan business and industry.

Publications

Basic Metallurgy of Irons and Steels. Glossop, D. I-4202-1-D-90

Staff:
Director: A. Rawa (B.Sc., P.Eng.)
D. Glossop (L.I.M.)
R. Levesque (B.E., P.Eng.)
A. Norman (P.Eng.)
B. Schidlowsky (R.N., C.P.S.)
J. Sher (B.Sc., P.Eng.)
L. Sopher (B.Ed.)
R. Wong (B.E., P.Eng.)
B. Zuk (B.A., B.E., P.Eng.)

PRODUCTIVITY AND QUALITY

The Productivity and Quality Division was formed to respond to the needs of industry for technologies that will improve efficiency and ensure production of quality products. The division has developed a Computer Integrated Enterprise (CIE) system that provides tools to solve productivity problems for manufacturers, service and distribution companies, and laboratories.

Certified quality professionals work with companies to implement quality control and assurance programs and systems. The systems are supported by ongoing audit services, training and documentation. National and international standards recognize these quality control and assurance systems.

Highlights

- Acquired and installed UNIX based support systems to enhance computer capabilities internally and for SRC clients.
- Developed capability to institute and audit quality programs.
- Adapted computer integrated productivity systems for Saskatchewan industry.

Publications

Final Report on the Use of Information Technologies at SRC Project. Hansen, C. I-4503-3-E-90

Investment Opportunity - Scientific Imaging Software. Spankie, J. Hansen, C. I-4506-6-E-90

Investment Opportunity - Medical Imaging. Spankie, J. Hansen, C. I-4506-7-E-90

An Anatomical Reconstruction Software Program. Spankie, J. Hansen, C. I-4506-8-E-90

Diagnostic Ultrasonography in Reproductive Biology. Spankie, J. Hansen, C. I-4506-9-E-90

Mechanical engineer Allan Malinoski provides certified welding engineering services to small and medium size enterprises (SMEs) throughout Saskatchewan. His expertise in design engineering for a variety of products and processes has also been used in technology transfer projects for SMEs in Canada and abroad.

Staff:
Director: J. Spankie (B.Sc., P.Eng.)
C. Hansen (M.B.A., B.Sc.)
C. Jahren (B.A.)
C. McKenzie (B.E., M.B.A., P.Eng.)
G. Pierce (M.Sc., B.E.)
L. Reich (B.Comm.)
R. Reich (Arch.Tech.)

EQUIPMENT AND MACHINERY DEVELOPMENT

The Equipment and Machinery Development Division offers a range of product development services for the conception, design, development, manufacture or modification of machinery.

Extensive project experience of the division's engineers, technologists, and marketing professionals provides clients with expertise for concept development, design, engineering analysis, and technical and market feasibility.

The division utilizes advanced methods and techniques that include computer aided engineering, for clients in the agriculture, forestry, mining, and transportation sectors.

Staff:
Director: D. Grier (B.E., P.Eng.)
D. Florizone (A.Sc.T., Mech.Eng.Tech.)
T. Kaminski (Ph.D., P.Eng.)
A. Malinoski (B.E., P.Eng.)
P. Patenaude (B.Comm.)
A. Udell (A.Sc.T., CAD/CAM Tech.)

Precision Instruments operates the Plastics Resource Centre, which specializes in the design of plastics products and the manufacture of precision tooling, such as moulds and other precision production equipment.

Highlights

- Provided retained certified welding engineering services to ten Saskatchewan steel fabricators.
- Conducted study of material-related problems in potash mines, to assess and prioritize the problems and identify solutions available from existing technology. Conducted finite element analysis of potash mine equipment.
- Developed procedures to evaluate the load carrying capacity for hauling grain at low speeds.
- Completed a diversity of product development assignments, ranging from instruments to large field machinery; developed and fabricated prototype machine to re-ink printer ribbons; designed fan testing facility and developed product testing procedures; designed an underwater seismic device and a chaff harvesting machine.
- Developed and evaluated a technology transfer system for the Jahore State Economic Development Council in Malaysia.

PRECISION INSTRUMENTS

The Precision Instruments Group provides specialized design and manufacturing services for scientific instrumentation products, laboratory automation systems, and specialized equipment for industry. Experienced design and production professionals offer a complete range of services and technical assistance in the areas of product design and development, precision machining and fabrication, small batch manufacturing, manufacturing process development and automation, specialized products, integrated services and prototype fabrication.

Plastics Resource Centre

The Precision Instruments Group also operates the Plastics Resource Centre which offers specialized technical services to clients who are taking product ideas to the marketplace. Expertise and technical services include plastics materials and process consulting, invention and product idea development, plastics parts and mould design, manufacture of mould systems, product design and cost analysis, manufacturing systems design, and prototyping.

Highlights

- Acquired an EDM Machine (electric discharge machining device) to enhance capabilities for the manufacture of complex shapes for plastics moulds.
- New software for the computer integrated manufacturing system resulted in higher project management efficiency.

Staff:
Manager: O. Olm
M. Peters
B. Seymour
G. van Dongen

- In cooperation with the University of Regina, participated in the development and construction of component parts for the Continuous Electron Boom Accelerator Facility. Advanced industrial materials are used in the project.
- Designed and developed moulds for the production of injection mould plastic radiation monitoring cartridges and a semiautomated assembly system.

ELECTRONICS

The Electronics Group provides services for the development and integration of electronic systems and components in manufacturing processes. Industrial measurement, control problem solving and design of instrumentation equipment were the primary focus of projects carried out by the group.

The group also specializes in assisting small and medium size manufacturers and start up companies in product development and the automation of manufacturing processes. The focus is on design and evaluation of new, microprocessor based products and automated or computerized processes.

Working with researchers and scientists, the group also provides unique instrumentation services for field trials for land and air monitoring projects. The high degree of expertise in automatic data acquisition systems and control systems is applied for the development of specialized instrumentation for environmental land, water and air monitoring.

Highlights

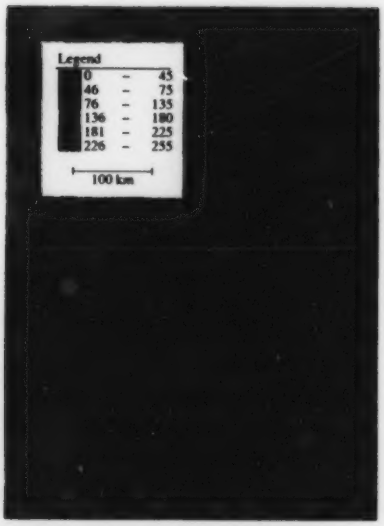
- Developed and installed a solar powered data acquisition system at the Cameco Weather Station at the McArthur River Site.
- Developed and installed systems to measure weather and radiation at the old Gunnar Uranium mine which broadcasts to satellite. Satellite data are received in West Virginia, from where they are transmitted via telephone lines by computer.
- Designed, fabricated and installed an automatic water quality monitor, capable of measuring pH levels, conductivity, oxygen and temperature for the Grand River Valley Conservation Area. Automatic telephone messages are transmitted to different stations to alert of variations in case readings are outside established limits.

Publications

MASS Programmer Operator's Manual. Young, K. I-4791-1-E-91

SRC engineers and technologists designed and manufactured the microprocessor based system for the Mini Tube Air Sampling System ™ and the Automated Thermo Desorption Unit, both of which are patented in Canada and the U.S.A.

Staff:
Manager: K. Young (B.Sc., B.Eng.)
K. Babich
B. Smith



This map of southern Saskatchewan uses data derived from satellite measurements (NOAA) to show the vegetation vigour during June 1988, a year when drought conditions affected pastures. GIS methods (in this case a compilation of data using satellite, pasture and survey data) are used to study drought conditions on Saskatchewan PFRA pastures.

SPATIAL INFORMATION

Activities and expertise of the division are focused on supporting the development of provincial resources. The division responds to current needs and anticipates future needs to develop these resources in an environmentally sustainable manner by delivering applied satellite image analysis to government agencies and industries involved in the exploration, development and management of Saskatchewan's resources.

Spatial technology is applied to assist industry to identify and explore resource opportunities in Saskatchewan. Services include geographic information systems (GIS), remote sensing image processing, and image analysis. The division has developed advanced methods of correlating satellite images and other types of data to better interpret the location and scope of Saskatchewan's resources.

Highlights

- Completed a four-phase study on the practical application of the NDVI parameter (parameter related to the vigour of grassland), using NOAA satellite data together with pasture observations, rainfall and pasture boundary information. The study will serve to improve pasture management techniques.
- Developed a digital elevation model of the topography of the bedrock surface covering the southern Prairie region. Technological requirements included development of drill hole data bases, digitizing several series of geological maps and application of various digital numerical systems which are now applied in the areas of mineral exploration, geological studies and potash, petroleum and groundwater resource management.
- Conducted a comparison study, comparing lineament features derived from analysis of LANDSAT imagery with structural and stratigraphic geological models derived from drill hole data. Conducted regional and local lineament analyses of LANDSAT TM (Thematic Mapper) imagery for Saskatchewan potash exploration to investigate subsurface structural features that were correlated to the computed lineaments in the area.
- Developed an applied prototype expert system that incorporates decision making rules for classifying rangeland conditions and for making recommendations on the ideal stocking rate for the land. The prototype model demonstrates the successful application of this technology to an extended set of variables that arises in rangeland classification work.
- Defined 15 land use categories for extraction and classification from LANDSAT TM imagery for regional scale studies of the NTS 62E (Weyburn) map sheet area. Produced geo-referenced, digital files suitable for input into the province's digital topographic mapping systems.

Staff:
Director: J. Whiting (M.Sc.)
J. Dyck (Ph.D.)
A. Michelet
N. Nicolichuk (Civ.Eng.Tech.)
J. Polson (B.Sc.)
J.W.J. Smith (B.Sc.)

- Produced hard copy maps from LANDSAT digital tapes of northern Saskatchewan for identifying surface features, such as roads, burns, and geological features that provide logistical and planning support for prospecting operations.
- Completed negotiations for a GIS development project which will use data in the areas of geology, topography, geophysics, and geochemistry. The project will involve data acquisition, transformation, geo-referencing, quality control, and input into a GIS workstation. The output will include computations and display of data resulting from a series of studies to synthesize and correlate multiple layers of data through modelling.

Publications

Radarsat for Saskatchewan: Technology Diffusion. Mellinger, M. E-2000-21-D-90

Remote Sensing and GIS for Crop Monitoring. Whiting, J. E-2000-12-A-90

Image Analysis Manual for VISILOG Software. Rousseau, A. E-2410-2-E-90

Study of Various Applications of Image Analysis. Rousseau, A. E-2410-4-E-90

Guide for VISILOG Demos. Rousseau, A. E-2410-5-E-90

Market Assessment for Using VISILOG. Rousseau, A. E-2410-6-E-90

Guide to Rangeland Classification: Expert System Model. Smith, J.W.J. E-2430-2-E-90

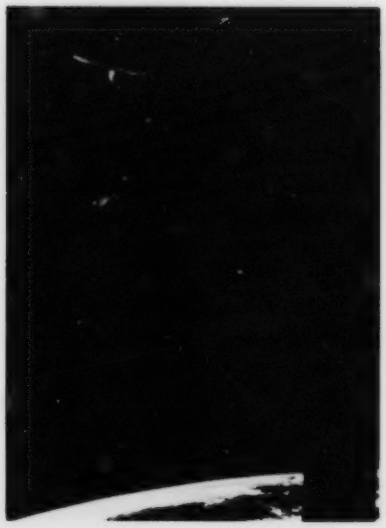
Market Analysis, Software, Hardware Assessment and Recommendations for Future Direction of the Image Analysis Component of the Spatial Information Division - Market Analysis and Recommendations Section. Polson, J. E-2000-2-E-91

Remote Sensing and Other Investigations at Petite Ville (FdNm-15). Brandon, J. E-2200-1-E-91

An ink jet plotter is used to produce land resource maps. This map was produced for a gold prospecting company for gold exploration in Saskatchewan's north. Maps are produced from digital data taken by satellites. The data are stored on computer tapes at the Prince Albert Satellite Receiving Station.

CORPORATE BUSINESS DEVELOPMENT

Corporate Business Development undertakes three kinds of activities. First, it identifies strategic partners of importance to SRC and develops mutually beneficial partnerships with them. These partnerships may include a memorandum of understanding, exchange of personnel to understand mutual needs and identify opportunities presented through these alliances. Second, development of policies and strategies within SRC which will result in improved business development for all SRC programs and services. Third, the branch takes on initiatives in specific technological areas where no champion has been identified so far.



The Mobile Servicing System (MSS) is Canada's contribution to the multipurpose international space station, the largest international technology development project ever undertaken. Canada's investment in the Space Station project will be just under $1.2 billion to the year 2001. Most of it will be spent in Canadian industry with some going to universities.

SPECIAL PROJECTS

Special Projects is a corporate business development function that develops strategies and provides analysis of new opportunities and pilot initiatives. Working collaboratively with all industrial sectors and multi levels of government, the director responds to and initiates new projects which do not fall within the area of responsibility of any existing SRC program.

The activities undertaken by the Special Projects Division strive to reinforce science and technology as a strategic element for enhancing the province's economic growth, security and competitive position.

Highlights

- Management of Strategic Technologies in Automation and Robotics (STEAR), a $1-million joint initiative by Saskatchewan Economic Development and Trade, Science and Technology Division and the Canadian Space Agency.
- Formed ADA Association in cooperation with three private sector firms to enhance growth of Saskatchewan's software industry by fostering skills in ADA, a programming language and general software engineering.
- From an initiative to the Kaon Factory Project, secured a contract for designing and building a production prototype of a photomultiplier tube base, developed by the University of Regina.
- Led an initiative in cooperation with the University of Saskatchewan to establish an industry-driven Centre of Excellence in Molecular Engineering that addresses pharmaceutical environmental, agricultural, and advanced materials opportunities.
- Participated in joint aerospace activities of the four western provinces, the Earth Environment Satellite Initiative (EESI).

Staff:
Director: John Bergsteinsson (B.Ed., B.Sc.)

TECHNOLOGY COMMERCIALIZATION

The Technology Commercialization Division is being established within the branch to fulfill a broad corporate responsibility in support of corporate business development.

Technology commercialization is defined as bringing technology from the research phase through development to the market place. The purpose is to add value to the technologies developed by SRC and others.

Staff:
Director: M. Mellinger (Doc.Spec., M.A.Sc., P.Eng.)

RESEARCH BRANCH

Acting Vice President: George MacKay, B.A., C.R.M.

The Research Branch focuses its activities on the sustainable development of the province's resources. The branch carries out research in the areas of petroleum recovery, production and upgrading; mineral exploration and processing; sustainable agricultural practices and value-added agricultural processing; alternative energy technologies; environmental process development and groundwater management.

Researchers work with the petroleum, mining, agriculture and energy industries in Saskatchewan to implement new technologies that will bring economic and environmental benefits to the province.

Senior research engineer Jerry Scoular is taking readings in the mobile field demulsification trailer.

Staff:
Director of Research: J. Hutchinson (M.S., B.A.Sc.)
J. Barker
E. Horn

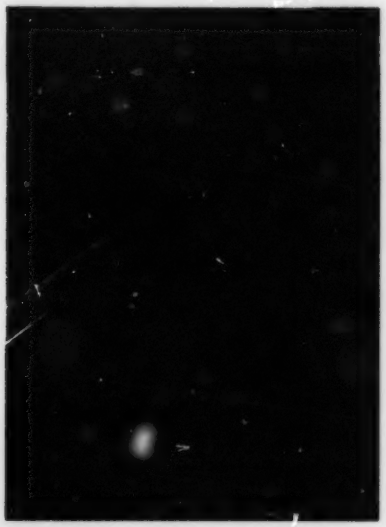
PETROLEUM

Petroleum research focuses on the technical problems and opportunities relating to the recovery of heavy oil reserves. Research expertise in reservoir engineering, chemistry and numerical modelling is applied to projects with individual companies and joint industry/government activities. Multiclient projects involving horizontal wells, steam injection, in-situ combustion and carbon dioxide injection address the technical challenges unique to Saskatchewan's oil and reservoir properties. A Technical Library provides up to date technical and scientific information to support petroleum research staff and clients.

Highlights

- Signed a memorandum of understanding (MOU) with CANMET to allow cooperation in petroleum research.
- Completed three oil recovery projects led by SaskOil. Continuation of one project is scheduled for Phase II and field application.
- Constructed a scaled physical model for an immiscible water-alternating-gas recovery project. Continued numerical modelling of field and laboratory systems.
- Held discussions on cooperative work with China's Research Institute of Petroleum Exploration and Development (RIPED).
- Presented a paper on miscible displacement at China/Canada joint conference in Beijing.

Staff:
Manager: E. Pappas (B.Sc., P.Eng.)
R. Exelby (Mech.Eng.Tech.)
N. Freitag (Ph.D., P.Eng.)
S. Huang (Ph.D.)
K. Hutchence (M.Sc.)
I. Kitamura
B. Kristoff (B.Sc., P.Eng.)
B. Schnell (Env.Sc.Tech.)
S. Schoon
K. Sterrenberg (Bio.Sc.Tech.)
B. Verkoczy (Ph.D.)



The inside of a scaled horizontal well physical model. Horizontal wells are increasingly used for heavy oil recovery.

Publications

Development of Methods for Predicting In-Situ Combustion Behaviour. Freitag, N. Exelby, R. P-110-158-C-90

Miscible Displacement of Saskatchewan Light and Medium Oil Reservoirs. Huang, S.S. Dyer, S. deWit, P. Shatilla, N. P-110-160-C-90

A Laboratory Study of Miscible Displacement in a Saskatchewan Light Oil Reservoir. Huang, S.S. Jha, K.N. P-110-174-D-90

Mechanistic Aspects and Chemistry of Immiscible Carbon Dioxide Flooding. Dyer, S.B. Farouq Ali, S.M. P-110-174-D-90

Factors Affecting Coking in Heavy Oil Cores, Oils and SARA Fractions Under Thermal Stress. Verkoczy, B. P-110-178-D-91

Enhanced Heavy Oil Recovery by Carbon Dioxide Injection. Huang, S.S. Dyer, S. Sterrenberg, K. Schnell, B. Kitamura, I. P-110-182-C-91

Ionization of Liquid Argon by X-Rays: Effect of Density on Electron Thermalization and Free Ion Yields. Huang, S.S. Gee, N. Freeman, G.R. (Published in *Radiat. Phys. Chem.*, Vol. 37, No. 3, pp. 417-421, 1991.) P-110-183-A-91

Thermal Studies of Heavy Oil Core Samples. Phase III. Verkoczy, B. Exelby, R. P-110-185-C-91

Physical and Numerical Modelling of a Horizontal Well/Reservoir System. Year 1. Kristoff, B. Gillies, R. Hutchence, K. Schoon, S. Small, M. Shook, C.A. P-110-187-C-91

Physical and Numerical Modelling Studies of the Tangleflags North Horizontal Well Steamflood Pilot Project. Sceptre Resources/Kristoff, B. P-100-157-C-90

Investigating the Application of a Water-Alternating-Gas Flood Using Produced Gas for the Senlac Heavy Oil Field. Nieuwenburg, G. (SaskOil)/Pappas, E. P-110-163-C-90

A Simulation Study of Air and Oxygen Fireflood Performance in a Lloydminster Heavy Oil Reservoir. SaskOil/Freitag, N. P-110-180-C-91

Development and Application of the Horizontal Saturation Pressure Grid for Lloydminster Heavy Oil Reservoirs. Nieuwenburg, G. (SaskOil)/ Pappas, E. P-110-181-C-91

PROCESS DEVELOPMENT

Staff

Manager: R. Ranganathan (Ph.D., P. Eng.)
E. Chung (B.Sc.)
N. Gaveronski
R. Gillies (M.Sc., P.Eng.)
S. Hill (CAD/CAM Tech.)
C. Jackson (B.Sc.)
L. Kurucz (Chem.Tech.)
J. Lundgren (Mech.Eng.Tech.)
J. Lychak
E. Ogu (M.Sc.)
G. Perron (Bio.Sc.Tech.)
P. Schergevitch
J. Scoular (B.Sc., P.Eng.)
M. Small (Chem.Tech.)
D. Soveran (B.Sc., P.Eng.)
M. Sulatisky (M.Sc., P.Eng.)

The division focuses on the development of new processes for the petroleum and mineral industries and for other industries that require environmental engineering research. Petroleum research projects address heavy oil production, transportation, and upgrading. In particular, multiclient projects focus on emulsion treatment, pitch coking and upgrading characteristics of heavy oil. Engineers in the division also work with Saskatchewan mineral producers to develop new processes for converting mineral resources to value added products.

The Alternative Energy Section evaluates compressed natural gas technologies for vehicles. Research on pipeline transport for bulk commodities, such as coal slurries and heavy oil, is conducted at the Pipeline Technology Centre, a world class test facility.

Highlights

- Constructed a horizontal well bore pipeline model to conduct a number of testing procedures. Conducted modelling of flow conditions in hydraulic hoisting systems and pipeline flow testing of high density tailing slurries for mine backfill applications. Developed and tested sampling and flow metering devices for tar sand slurries.
- Conducted compressed natural gas fleet demonstrations for Saskatchewan's "Natural Gas Vehicles Program".
- Scaled up and tested a new technology at a mine site to produce value-added products from sodium sulphate.
- Continued the joint upgrading research project with the Idemitsu-Kosan Co. of Japan. The project includes personnel exchanges of SRC and Japanese scientists. Japan conducted a pilot scale test with Saskatchewan heavy oil.
- Signed a specific project agreement with CANMET to work jointly in emulsion characterization and treatment.
- The "Fuels from Vegetable Oil Technology", developed by SRC, was awarded the U.S. patent. The Canadian patent is pending. The technology is now being promoted by an industrial licensor.
- Presented a paper on downhole emulsification at China/Canada Joint Conference in Beijing.

Publications

Breaking Wellhead Emulsions. Scoular, R.J. P-110-175-D-90

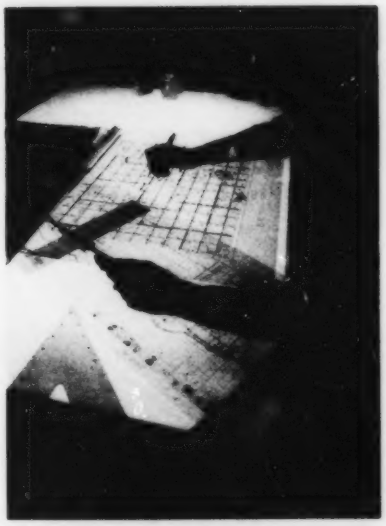
Upgrading of Biomass Oils to Cetane Enhancers. Soveran, D.W. P-110-176-D-91

Emulsions Research. Scoular, J. Kurucz, L. Verkoczy, B. Mikula, R.J. MacConnachie, C.A. Paqette, C. Munoz, V.A. P-110-186-C-91

Demonstrations of Compressed Natural Gas on Farms. Sulatisky, M. Hill, S. X-3210-7-E-90

Compressed Natural Gas Demonstrations on Farms: Data Report. Hill, S. Sulatisky, M. X-3210-8-E-90

Compressed Natural Gas Demonstrations on Farms: Truck Report. Hill, S. Sulatisky, M. X-3210-9-E-90



In the water resources field, research scientist Mac Millard interprets aquifer information to produce geology and groundwater maps.

RESOURCES

The Resources Division carries out regional and topical geological investigations in support of mineral resource exploration and development in Saskatchewan. Current activities include resource assessment and product diversification in industrial minerals and modelling of ore genesis, host rock alteration and structure in metallic minerals. Recent developments in drift prospecting techniques have led to the discovery of several gold deposits in Saskatchewan.

The identification, development and management of groundwater resources is another major area within the division. Groundwater

Staff:
Manager: B. Schreiner (Ph.D., P.Eng.)
I. Annesley (Ph.D.)
J. Campbell (M.Sc.)
E. Jaworski (R.R.Tech.)
H. Maathuis (M.Sc.)
C. Madore
M. Millard (M.Sc.)
D. Quirt (M.A.Sc.)
M. Simpson (B.A.)
J. Stoutenburg (B.Sc.)
T. Warkentin (Chem.Tech.)
D. Zipko (A.Sc.T.)

Research technologists in the Mineralogical Lab separate heavy mineral fractions from till samples. While indicator minerals are separated out in diamond exploration, in gold exploration, gold grains are separated out of the till sample.

investigations carried out by division staff for domestic, municipal and industrial purposes are vital to the economy of the province. Groundwater mapping, observation wells and resource evaluations provide valuable information for the effective and efficient management of Saskatchewan's groundwater resources.

The Resources Division also offers integrated geoscience services through the Geochemical Laboratory, the Mineralogical Laboratory and the Diamond Processing Pilot Plant.

Geochemical Analysis

The Geochemical Laboratory offers comprehensive chemical analysis of exploration samples, such as rocks, sediments, soils, organics and vegetation. Modern techniques in sample preparation and digestion, analytical chemistry and computer-based data management are used in the laboratory. Additional services offered by the laboratory include collection, count and description of gold grains in samples; separation of minerals, including diamonds, according to their specific gravity; and fire assay analysis for precious metals.

- In 1990-91, the laboratory analyzed approximately 27,000 samples: 2,541 till samples for heavy minerals and gold grains; 13,273 samples for fire assay; 452 diamond exploration samples; 11,000 uranium exploration samples; and 50 tons of kimberlite for diamonds.

Mineralogical Analysis

The Mineralogical Laboratory uses x-ray diffraction analysis to analyze and process samples for mineral identification and rock characterization. The laboratory primarily evaluated industrial mineral deposits - silica sand and clay minerals.

Mineral Processing

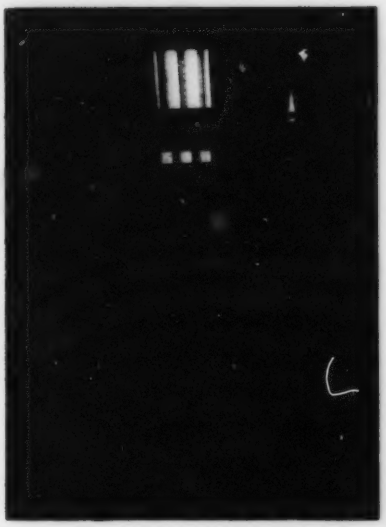
The Diamond Processing Pilot Plant assesses bulk samples of kimberlite to assist in the exploration and development of Saskatchewan's diamond deposits.

Staff:
Manager: A. Holsten (B.Sc.)
P. Archibald (B.A., G.C.)
T. Armstrong (G.C.H.)
B. Bell (G.C.)
S. Cutts
B. Gartner
A. Jackson
C. McClelland
P. Pridham
L. Turple (B.Sc.)

Highlights

- Provided Quaternary geology services (glacial drift investigations and analysis) to industries pursuing opportunities in the diamond play area.
- Completed the second year of a multi-year project on vertical migration of saline fluids for the Saskatchewan Potash Producers Association.

- Completed drift prospecting contracts relating to investigations into gold and platinum resources within the province.
- Completed a Kimberlite Minerals Study in the southwest portion of the province for the minerals industry.
- Continued a multiclient project on groundwater flow and contaminant transport research in the Condie Aquifer, Regina area.
- Conducted a review of groundwater quality monitoring data for Ipsco Inc., in Regina.
- Initiated an International Development Research Centre (IDRC) sponsored groundwater research project in Jakarta, Indonesia between BBP Teknologi, McGill University, the Saskatchewan Research Council and the Indonesian government.
- Completed the final year of a multiclient project on the complex geology of Archean and Aphebian rocks underlying uranium deposits in the Athabasca Basin.
- Continued investigations of the geological processes for the formation of the uranium and gold deposits and defined exploration criteria for deposits in certain geological settings.



An Inductively Coupled Plasma (ICP) is used to measure the emission spectrum of a geological sample. As the sample passes through the plasma at close to 5000 ° C, elements contained in the sample emit light at a characteristic wavelength which is measured to determine the quantity of that element within the sample.

Publications

Interim Report on Project Ceramic Whitewares Ecuador. December 1989 - July 1990. Hudson, J.H. R-1410-1-E-90

Evaluation of the Groundwater Resources in the Yorkton Area. Maathuis, H. R-1220-2-B-90

Water Quality Monitoring at IPSCO Inc., Regina - July, 1990 Monitoring. Maathuis, H. Zlipko, D. Jaworski, E.J. R-1220-3-E-90

Metasomatic Host-rock Alteration at the Frontier Au Prospect, Goldfields Area, Saskatchewan. Quirt, D. R-1230-7-A-90

Lithogeochemistry and XRD Mineralogy of Martin Group and Related Rocks, Beaverlodge Area, Saskatchewan. Quirt, D. R-1230-8-A-90

Evaluation of the Hudson Bay Silica Deposit Using Existing Data and Information. Quirt, D. R-1230-9-E-90

1990 Field Notes - Outcrop. Annesley, I.R. Madore, C. R-1240-3-E-90

1990 Field Notes - Drill Core. Annesley, I.R. R-1240-4-E-90

1990 Field Notes - Geochronology. Annesley, I.R. Madore, C. R-1240-5-E-90

The Wollaston Group and Its Underlying Archean Basement in Saskatchewan: 1990 Subsurface and Bedrock Geological Mapping. Annesley, I.R. Madore, C. R-1240-6-A-90

Appendix A. Review of Techniques for Measuring Subsurface Brine Migration. Revised. Maathuis, H. R-1210-1-E-91

Water Quality Monitoring at IPSCO Inc., Regina, Fall Monitoring. Maathuis, H. Zlipko, D. Jaworski, E.J. R-1220-1-E-91

Water Quality Data for Piezometers IPSCO 806 to 809. Maathuis, H. Zlipko, D. Jaworski, E.J. R-1220-2-E-91

Research technologist Mark Gimby conducts field days in different areas of the province to demonstrate new research methods and farming techniques for organic farmers.

Well Inventory and Groundwater Quality Survey in the Vicinity of the Miller Western Pulp Mill, Meadow Lake, Saskatchewan. Maathuis, H. Zlipko, D. Jaworski, E.J. R-1220-3-E-91

Construction of and Water Quality Data for IPSCO Inc., Landfarm Piezometer IPSCO 810 (GE 810). Maathuis, H. Jaworski, E.J. Zlipko, D. Adelman, T. R-1220-4-E-91

A Modified CIPW Normative Calculation Program. Quirt, D. R-1230-1-E-91

RURAL DEVELOPMENT

The division initiates applied research and demonstration projects to assist in the development of Saskatchewan's rural economy. Scientists and engineers are examining new opportunities to increase the value-added capabilities of agriculture through sustainable agricultural practices and regional processing centres.

Efforts in sustainable agriculture include organic agriculture, agroforestry and agroecosystems. The focus is on the development of farming practices and cropping systems that will increase farm net income using energy efficient, environmentally sustainable practices.

R&D opportunities in regional processing are being evaluated to provide future business opportunities to rural communities. Based on the idea of shared infrastructure, producing products of the highest value, and optimum use of raw materials, this concept could provide significant opportunities for Saskatchewan communities.

Highlights

- Completed the first year of a major, four-year demonstration study on the viability of organic farming methods. The study monitors weed control effectiveness, soil fertility techniques, yields, costs and returns. Four field days in different parts of the province demonstrated new research methods and farming techniques.
- Conducted a study to identify innovative cropping systems which generate more net income than conventional wheat production systems and produce products suitable for processing in regional processing centres.
- Investigated the economic viability of agroforestry systems using double or multiple row shelterbelts in the black and grey-wooded soil zones of Saskatchewan. The systems that couple tree harvest for timber with the enhanced crop yields afforded by the shelterbelt effect show that improvement in farm income was substantial.
- Completed research showing that small amounts of enzymes could be used to treat canola seed for increased yield of oil and to improve the quality of the oil.

Staff
Manager: W. Craig (Ph.D.)
M. Gimby (Dip.Agr.)
J. Kernan (M.A.)
A. Mair (Bio.Sci.Tech.)
K. Sosulski (Ph.D.)
E. Swerhone (Bio.Sci.Tech.)

- Completed a study to determine that kochia could be used as a high yielding annual forage crop for saline soils. The economic value of wild kochia, harvested as an emergency forage in southern Saskatchewan after the drought of 1988, was calculated to be $7 million.
- Completed a study to show that ammoniation could be used to improve the feed value of grain screenings and destroy the germination of weed seeds in screenings, so that they could be used for cattle feed.
- In collaboration with the University of Saskatchewan, transferred micropropagation technology to the provincial horticulture industry.
- Investigated the utilization of waste heat from existing processing operations as a method to expand Saskatchewan's greenhouse production capacity.

Research found that chaff can be used as an economical feed source for beef cattle.

Publications

Cereal Chaff as a Ruminant Feed: Overview. Kernan, J.A. Knipfel, J.E. Coxworth, E.C. R-1500-2-A-90

Feasibility of Regional Rural Processing Centres. Coxworth, E. Olsen, G. R-1520-2-E-90

Viability of Organic Farm Practices. Progress Report. Rutherford, A. Gimby, M. Coxworth, E. R-1530-2-E-90

Development of Quinoa as a New Grain Crop: Research on Agronomics and Saline Tolerance. Kernan, J.A. Gimby, M. Townley-Smith, L. Green, D. Steppuhn, H. R-1550-3-E-90

The Nutritive Value of Awned and Non-awned Wheat Chaffs and Their Responses to Ammoniation. Kernan, J.A. Knipfel, J.E. Crowle, W.L. Coxworth, E.C. Mair, A.E. R-1550-6-E-90

Drought Proofing Cattle Feed Supplies with Kochia. Coxworth. E. Green, D. Knipfel, J. Kernan, J. Hanson, J. Steppuhn, H. R-1550-7-E-90

Agronomic and Environmental Factors Affecting the Feed Composition and Yield of Kochia (Kochia scoparia L. Schrad) Forage. Coxworth, E. Green, D. Kernan, J. Knipfel, J.E. R-1550-9-D-90

Development of Specification Sheets to Aid Marketing of Oat Products by CanMar Grain Incorporated, Regina, Sask. Sosulski, K. R-1560-4-E-90

Preference and Performance in Grasshopper, Melanoplus Sanguinipes (Orthoptera: Acrididae), Feeding on Kochia, Oats and Wheat: Implications for Population Dynamics. Hinks, C.F. Olfert, O. Westcott, N.D. Coxworth, E.M. Craig, E. Econ, J. Entomology 83: 1338-1343 (1990)

Studies on the Feeding Value of Kochia scoparia (L.) Schrad. Hay for Beef Cattle. Cohen, R.D.H. Iwaasa, A.D. Mann, M.E. Coxworth, E. Kernan, J. Can.J.Anim.Sci. 69: 735-743 (1990)

Composition of Dietary Fibre Components in Oyster Mushrooms. Sosulski, K. 33rd CIFST Conference, Saskatoon, June 3-6, 1990

Total Compositional Analysis of Domestic and Wild Oat Bran. Sosulski, K. Sosulski, F. 33rd CIFST Conference, Saskatoon, June 3-6, 1990

Thermal Inactivation Kinetics of Wheat Germ Lipoxygenase (LPO): 1. Optimization of LPO Assay Methods by Response Surface Methodology. Bhirud, P.R. Sosulski, F.W. Sosulski, K. 33rd CIFST Conference, Saskatoon, June 3-6, 1990

Micropropagation is a technology capable of producing large numbers of identical, potentially disease free plants.

Thermal Inactivation Kinetics of Wheat Germ Lipoxygenase (LPO): 2. Optimization of Extraction Conditions for LPO Activity Recovery from Wheat Germ. Bhirud, P.R. Sosulski, F.W. Sosulski, K. 33rd CIFST Conference, Saskatoon, June 3-6, 1990

Saskatchewan Responses to Global Warming - Agriculture. Coxworth, E. R-1500-1-E-91

Cereal Chaff: Effect on Ammoniation Conditions in vitro on Nutritive Value. Kernan, J.A. Coxworth, E.C. Knipfel, J.E. Mair, A.E. Racz, V. R-1500-2-A-91

Allelopathy (naturally occurring herbicides) in Agriculture and Forestry. Coxworth, E. R-1510-1-D-91

Review and Future Strategies on Utilizing Hydroprocessed Plant Oils in Diesel Fuels. Coxworth, E. R-1520-1-E-91

Sustainable Agriculture and Regional Processing Centres. Coxworth, E. R-1520-2-D-91

Agroforestry for Western Canada. Coxworth, E. R-1520-3-E-91

Viability of Organic Farm Practices. First Year Annual Report. Rutherford, A. Gimby, M. Coxworth, E. R-1530-1-E-91

Chaff for Livestock Feed. Rutherford, A. Gimby, M. R-1540-1-E-91

Chaff in Feeder Cattle Rations. Rutherford, A. Gimby, M. R-1540-2-E-91

Development of Quinoa as a New Grain Crop: Research on Marketing and Processing. Phase III. Kernan, J.A. Benesh, J.L. Brunner, K. Swerhone, E.K. R-1550-2-E-91

Quality of Oil and Meal from Enzyme-treated Canola Seeds. Sosulski, K. Sosulski, F.W. R-1560-1-D-91

Presscakes from Enzyme-treated Canola as a Source of Protein for Broilers. Sosulski, K. Thacker, P. R-1560-2-E-91

Enzyme Pretreatment to Enhance Oil Extractability in Canola, Chapter 16, in Canola and Rapeseed. Production, Chemistry, Nutrition and Processing Technology. Sosulski, K. Sosulski, F.W. R-1560-3-A-91

Effect of Enzyme Pretreatment of Canola on Yield and Quality of Expeller Oil and Meal. Sosulski, K. Sosulski, F.W. R-1560-4-D-91

SRC scientist Krystyna Sosulski is determining enzyme activity in mushroom substrate. The use of enzymes as a biological process could replace the chemical processes currently used within the pulp and paper industry.

OPERATIONS BRANCH

Vice President: George MacKay, B.A., C.R.M.
Staff: G. Hanson (B.A.)

The two service laboratories in the branch, Analytical Services and the Bovine Blood Typing Laboratory, both experienced continued growth in their operations. The Environment Technology Division was integrated into branch operations.

The Operations Branch provides corporate services for the organization. Computerized systems were introduced in accounting services, purchasing and inventory control to improve services to internal and external clients.

The branch also provides management services under contract to the Prairie Agricultural Machinery Institute (PAMI).

Highlights

- Implemented an Employee and Family Assistance Program, administered through the offices of professional counsellors on a strictly confidential basis.
- With the approval of 90 percent of employees, the SRC Pension Plan was changed to a money purchase plan based on Group RRSPs.
- Contracted new group insurance and dental plan benefits carriers, resulting in improved services to employees, reduced costs and simplified administrative procedures.
- Developed a corporate communications strategy. Introduced an internal staff newsletter, published three times per year.
- Streamlined the purchasing system, resulting in reduction of waste and reduced inventory requirements.
- Commissioned an indoor air quality study for the West Wing to redress potential health risks for some staff.
- PAMI's Strategic Plan is successful, with employees exceeding established goals.
- PAMI completed construction of a confidential test building, providing a secure environment to conduct tests and accommodating the increased demand for services.
- PAMI, together with industry partners, formed WESTEST, a new testing organization which provides unique services, such as vibration testing and sound intensity, for Western Canadian manufacturers.

Publications

Proceedings of the 4th Canadian Symposium on Mining Automation - September 16-18, 1990, Saskatoon, Canada. Wilson, J.N., Ed. A-752-1-D-90

Climatologist Elaine Wheaton reviews a publication with graphic designer Hans Piek (right) and communications manager John MacIntosh.

Financial Services Staff:
Controller: R.J. McGrath (M.B.A., C.M.A.)
R. Dick (B.A.)
M. Dymond
B. Hoyseth
M. Millhouse

Human Resources Staff:
Manager: E. Smith (Ph.D.)
J. France (M.A.)
M. Limet
Safety Officer: J. Meginbir (B.A.)

Properties & Facility Services Staff:
Manager: K. Owens (B.A.C.)
R. Bouvier
V. Cherepacha
I. Coleman
D. Collins
D. Friesen (B.A.)
J. Giesinger
B. Marshall
D. McEwan
G. McLean
N. Nepper
J. Neufeld
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J. Schultz
P. Sherwood
J. Wright

Information Services Staff:
Manager: M. Samms (Lib.Tech.)
C. MacLeod
R. Middleton
C. Peters

Technical Information Services Staff:
D. Sinclair
N. Zerr

Communications/Graphics & Publications Staff:
Manager: J. MacIntosh
G. Burmeister
P. Greenidge
C. Sardinha
J. Mamer
B. McIntosh
H.G. Piek
L. Weegar

Researchers in SRC's Aquatic Biology Section are working with industry, government and private sector environmental consultants to ensure responsible management of our aquatic ecosystem.

Management Support Staff:
C. Beaulieu (B.A.)
Y. Wilkinson

ENVIRONMENT TECHNOLOGY

Environment Technology provides scientific and technical research services in support of the management of Saskatchewan's ecosystems. Scientists and researchers work with industry and government to assess developments and their impacts on the environment, in order to adapt technologies and develop mitigation measures that meet Saskatchewan requirements.

Multidisciplinary teams offer specialized expertise in the area of data collection and interpretation related to Saskatchewan's unique environment and work with clients to identify their needs for scientific research and technical environmental information. This information is needed to complement sustainable industrial development and the effective management of our natural resources. The understanding of scientific evidence connected with environmental impacts assists in the development of solutions now, and ensures effective management of Saskatchewan's ecosystem in the future.

Water quality and supply, air quality, waste and land management and global change are major research areas that best serve private sector developers and the Province of Saskatchewan in achieving a sustainable economic future.

Research projects involving technology transfer, scientific research and technical problem solving are conducted for the private sector and the province.

AQUATIC BIOLOGY

Efforts are concentrated at three levels of ecological organization: bioassays, for the assessment of habitat quality, including toxicity levels; biological community methods, for water body characterization, impact and restoration assessments; and ecosystem methods, for the assessment of regional and more global patterns and impacts.

Highlights

- A new, highly specialized Aquatic Biology Laboratory was established to allow for the development of reliable toxicity tests using fish species native to Saskatchewan. The lab will also enhance research aimed at developing certain types of toxicity tests using early life-stages of fish, particularly larvae and eggs.
- Assisted with development of aquatic environmental effects monitoring guidelines at pulp and paper mills, as part of a technical advisory group of Environment Canada.

Staff:
Lead Scientist: G. Melville (Ph.D.)
J. Matamala
B. Paquin

WATER QUALITY

Water Quality undertakes research projects in four major areas. Development of sensitive algae and aquatic plant bioassays will be

used in hazard assessments, risk mitigation and establishment of non-impact zones for pesticides and other toxic compounds.

The safety and quality of drinking water is a concern to many communities. Research is underway that will mitigate taste, odour and toxic compounds created by blue-green algae (cyanobacteria) in drinking water supplies. Work is also being carried out concerning the sources and reduction of dissolved organics in drinking water.

Surface waters, such as drinking water reservoirs, stormwater retention ponds, sewage lagoons and commercial ponds are subject to high nutrient loads. Research is being conducted to process the nutrients. Forced nutrient channelling is a method by which nutrients in these waters are forced into biomass to prevent aesthetic and health problems.

Nick Christofi (front) from the Napier Polytechnic in Edinburgh, Scotland and Hans Peterson collect water samples to evaluate the physical and biological factors that control algae blooms.

Highlights

- Launched biennial newsletter *Prairie Water News,* cosponsored by SaskWater Corporation, Alberta Agriculture and the Prairie Farm Rehabilitation Administration of Agriculture Canada.
- Appointed to Natural Sciences and Engineering Research Council to work on "Aesthetic and health significance of biogenic compounds in drinking water".
- Developed non-target plant toxicity tests for pesticides.
- Organized national conference and workshop on farm surface water quality, cosponsored by Alberta Agriculture and the Prairie Farm Rehabilitation Administration of Agriculture Canada.

Publications

Toxicity Testing Using a Chemostat-Grown Green Alga, Selenastrum capricornutum. Peterson, H.G. E-2120-3-D-90

ASTM Second Symposium on Plants for Toxicity Assessment Aquatic Plant Toxicity Testing: Recommendations for Test Species. Swanson, S.M. Rickard, C.P. Freemark, K.E. MacQuarrie, P. E-2130-2-D-90

Evaluation of Fate and Toxicity of Diclofop-methyl Using an Aquatic Model Ecosystem. Lintott, D.R. E-2130-4-D-90

Bioassay Results for Sewage Effluent from the Saskatoon Water Treatment Plant, September, 1989. Swanson, S.M. Paquin, B. Rickard, D. E-2130-5-E-90

Odorous Substances and Cyanobacterial Toxins in Prairie Drinking Water Sources. Kenefick, S.L. Hrudey, S.E. Prepas, E.E. Motkosky, N. Peterson, H.G. (Submitted to Journal Wat.Sci.Technol., 1991)

Algae Problems in Dugouts. Peterson, H.G. *Prairie Water News 1, 4-5. 1991.*

Fighting Water Blooms. Peterson, H.G. *Prairie Water News 1, 5. 1991.*

Development of Guidelines for Testing Pesticide Toxicity to Nontarget Plants for Canada. Freemark, K. MacQuarrie, P. Swanson, S. Peterson, H.G. *Plants for Toxicity Assessment, ASTM STP 1091* (1990). W. Wang, J.W. Gorsuch and W.R. Lower, Eds., American Society for Testing and Materials, Philadelphia, pp. 14-29.

Staff:
Lead Scientist: H.G. Peterson (Ph.D.)
M. Moody (B.Sc.)
N. Ruecker (B.Sc.)

In a controlled field experiment near Lloydminster, Saskatchewan, SRC researchers are applying drilling wastes to assess the effect of the wastes on soils and crops.

APPLIED PLANT ECOLOGY

Applied Plant Ecology focuses on the natural vegetation of Saskatchewan: inventory, management for sustainable economic use, and conservation. Researchers provide range managers with information to assess and measure grazing capacity and range condition, primarily in southern Saskatchewan. Other projects deal with the management of areas with native vegetation for a variety of uses, such as grazing, wildlife habitat, and outdoor recreation. In northern Saskatchewan, the emphasis is on classification and mapping of forest land into ecological types, used by forest managers to predict rates of wood production and assess wildlife habitat. The section also investigates the effects of contaminants in the terrestrial environment. A number of projects have helped the oil industry assess the effects of disposal of waste products and of natural gas leakage from wells on soils and plants.

Highlights

- Completed a study on the effects of migration of natural gas from capped oil wells to measure the damage to soils and crops that occurs around a leaking well.
- Completed a long-term study of the effects of applying drilling wastes to farmland. Soil properties, crop yields, and crop chemistry were measured to detect changes caused by waste application.
- Completed several reports on assessment procedures for Saskatchewan rangelands. The reports are widely used by land managers to assess grazing capacity and measure range condition.
- Completed a study on the vegetation which is invading and stabilizing the exposed bed of Old Wives Lake, following the dry years of the later 1980s.
- Completed a report on forest site classification in Saskatchewan, assessing present methods of mapping land to predict forest productivity. Developed an approach for improving site classification.
- Mapped the soil properties along 80 km of powerline in southeastern Manitoba to locate areas where soil-mobile herbicides should not be used because of the risk of movement into groundwater.

Publications

Progress Report: Response of Plants and Soils to Natural Gas. Godwin, B. E-2510-2-E-90

Response of Soils and Plants to Natural Gas Migration from Two Wells in the Lloydminster Area. Godwin, R.C. Abouguendia, Z. Thorpe, J.P. E-2510-3-E-90

An Assessment of Stabilization Options for the Exposed Old Wives Lakebed. Godwin, R.C. Abouguendia, Z.M. Thorpe, J.P. Lauzon, R. E-2520-5-E-90

An Assessment of Saskatchewan's System of Forest Site Classification. Thorpe, J. E-2530-1-E-90

Site Mapping for Risk of Picloram Application on a Powerline in Southeastern Manitoba. Thorpe, J. E-2530-1-E-91

Staff:
Lead Scientist: J. Thorpe (Ph.D.)
B. Godwin (B.S.A.)

CLIMATOLOGY

Climatological research is focused on assessing climatic factors that affect regional economies and ecological systems. As part of an international network of environment databases, SRC's Climatology Section provides information for Canada's environmental and social-economic planning strategy. Researchers are recognized for their work in the areas of global warming and climatic change impact. The section develops future climatic change scenarios, identifies potential impacts on several resource sectors, and develops strategies to mitigate the environmental and economic effects of climatic change and variability.

Highlights

- Drafted report dealing with the environmental and economic impacts of the 1988 drought.
- Completed the first-ever scientific study on "Dust Storms in the Canadian Prairies", which reveals that Saskatchewan has the highest risk of dust storms and identifies their costly and numerous effects.
- Investigated and reported on the relationship between ecosystems and climate to enable the development of strategies that minimize negative impacts and maximize benefits of climatic change.
- Formulated 16 recommendations for action as part of the provincial Task Force on Soil-Water-Wetlands Management.

Publications

Boreal Forest Sensitivity to Global Warming: Implications for Forest Industries in Western Interior Canada. Wheaton, E.E. E-2000-15-E-90

Adapting Agriculture to Climatic Change. Wheaton, E.E. E-2330-3-D-90

The Drought of 1988. Wheaton, E.E. Arthur, L.M. Wittrock, V. Whiting, J. Thorpe, J. Shewchuk, S. E-2330-4-E-90

Frequency and Severity of Drought and Dust Storms. Wheaton, E.E. E-2330-5-D-90

Report of the Task Force on Soil-Water-Wetlands Management in Saskatchewan - Summary. Zagrodney, J. Wheaton, E.E. Kennett, E. Blackwell, R. Piercy, J. E-2330-6-E-90

Report of the Task Force on Soil-Water-Wetlands Management in Saskatchewan. Zagrodney, J. Wheaton, E. Kennett, E. Blackwell, R. Piercy, J. E-2330-7-E-90

Climatic Change and Wind Erosion by Dust Storms. Wheaton, E.E. Wittrock, V. E-2330-8-D-90

Global Warming Impacts on Boreal Ecosystem Productivity in Western Canada. Singh, T. Wheaton, E.E. E-2330-9-D-90

Saskatoon SRC Climatological Reference Station Annual Summary, 1990. Wittrock, V. Wheaton, E.E. E-2330-1-B-91

Report to the Expert Committee on Agrometeorology - Automated Data Acquisition and Standards. Berry, R.L. Edey, S.N. Wheaton, E.E. King K.M. E-2330-2-E-91

The Campbell-Stokes Bright Sunshine Recorder measures the amount of bright sunshine we receive. In 1990, Saskatoon received a total of 2,302.4 hours of bright sunshine and in 1991, 2,263.4 hours, which is 96% and 94% of normal, respectively.

Staff:
Lead Scientist: E. Wheaton (M.Sc.)
V. Wittrock (B.Sc.)

SRC scientist Stan Shewchuk measures dye tracer with a fluorescence spectrophotometer as part of a spraydrift monitoring project.

ATMOSPHERIC SCIENCES

Multidisciplinary research teams investigate atmospheric processes affecting agricultural and forestry production, including measurement of air pollution levels and acid rain deposition. Services include measurement of pesticide spray drift and the determination of pesticide vapour flux and mass balance, as well as assessments of the effectiveness of sprayer technologies and methodologies. Working with industry and government clients, the section carries out diffusion modelling for environmental impact studies, air pollution modelling and, in particular, plume dispersion modelling. Researchers in the section specialize in the development of meteorological and remote monitoring instrumentation.

Highlights

- Completed a full-scale field study to determine the deposition and spray drift of herbicides onto forest canopies and assisted with integrating new air sampling systems into ongoing operational forestry management programs.
- Completed a study to determine the effects of carbofuran deposition on wildlife.
- Designed, installed and monitored a series of meteorological instruments, used to schedule irrigation systems.
- Studied diffusion of radionuclides in the vicinity of a mine site, estimating atmospheric concentrations and depositions for typical weather systems in the region of the mine site. The information is used to assess the impact of long term emission on the ecosystem of the environment.

Publications

Spray Drift and Deposit Measurements from a Forestry Herbicide Application. Shewchuk, S.R. Wallace, K. Maybank, J. E-2000-21-D-90

A Comparison of Data Between Co-located Automatic and Manual Climatic Data Taken at a Climatological Reference Station. Shewchuk, S.R. Smith, B.J. Nicolichuk, N. E-2300-2-E-90

Assessment of Carbofuran Spray Drift Deposit on Mallard Ducklings. Shewchuk, S.R. Wallace, K. E-2310-6-E-90

An Automated Recording Class A Evaporation Pan Comparison Study. Shewchuk, S.R. Smith, B.J. E-2300-1-E-91

Preliminary Review of the Saskatchewan Pork Industry Recommendations for Manure Management: Air Quality Considerations Only. Shewchuk, S.R. E-2300-3-E-91

Progress on the 1990 Operation and Maintenance of the Luck Lake Irrigation Meteorological Data Acquisition System. Shewchuk, S.R. Smith, B.J. E-2310-1-E-91

Staff:
Lead Scientist: S. Shewchuk (Ph.D.)

AIR QUALITY

Research and services focus on assisting industry in meeting environmental regulations and guidelines on air quality standards. Air Quality Section staff are expert in the areas of environmental chemistry, computer applications, materials identification and environmental sampling of both indoor and outdoor environments. Investigations range from stack emissions to indoor air studies and spray drift research for the benefit of Saskatchewan residents. With a 49.8% increase in demand for services during 1990-91, the section recorded its best year ever.

Publications

Comments on the Proposed Environmental Work at IPSCO. Wallace, K. E-2000-15-E-90

A Review of the Air Quality at Cluff Lake (1983-1989) with Respect to the Original Assessment (1976). Wallace, K. E-2130-3-E-90

Herbicide Spray Drift Research, 1990 Field Tests of Four Sprayers. Wallace, K. Shewchuk, S.R. Maybank, J. Wolf, T. Grover, R. E-2310-8-E-90

Research technician Emie Lennox makes starch cells used in the electorphoresis process.

Staff:
Lead Scientist: K. Wallace (B.Sc.)
R. Begrand (B.Sc.)
R. Jahren (B.Sc.)

BOVINE BLOOD TYPING LABORATORY

The Bovine Blood Typing Laboratory is the parentage testing centre for the Canadian livestock industry. The laboratory operates under the direction of Bova-Can Parentage Testing Inc., an advisory board comprised of representatives from several national breed associations. The laboratory and its assets are owned by the industry, but operated through a management contract with SRC.

In addition to providing parentage verification, the blood typing laboratory offers a number of diagnostic services, including DNA fingerprinting, kappa-casein variant typing and karyotyping. A relatively new technology, DNA fingerprinting is rapidly gaining the reputation of being the most accurate procedure for parentage verification. The DNA test is also used to detect the kappa-casein genes in bulls and non-lactating cows. Kappa-casein is an important milk protein which exists in various genetic forms. It has been shown that some genetic variants of this protein have better properties for cheese production than others. A simple test is available to dairy farmers to detect the main kappa-casein types.

The Canadian beef and dairy industries are primary clients of the blood typing lab. Tests have also been performed for breeders of elk, sheep, goats, swine, dogs and ostriches. The blood lab uses internationally recognized methods and state-of-the-art technology to support the worldwide trade of Canadian animals.

Collaborative research continues with the University of Saskatchewan in the field of cattle gene mapping and wildlife genetics.

Staff:
Manager: G. Kraay (Ph.D.)
S. Dolezsar (B.Sc.)
V. Gerwing (B.Sc.)
K. Grayson
U. Hollmann
K. Lang (B.Sc.)
E. Lennox (C.T.)
B. Mann (C.T.)
Y. Plante (Ph.D.)
L. Polishchuk (R.T.)
D. Wright (R.T.)

Research scientist Vicky Gerwing reads gels to interpret protein variants as part of the blood typing process for parentage verification. All parentage test results are stored on the lab's computerized system.

Highlights

- A new service for dairy cattle breeders was introduced which determines the kappa-casein variant, a milk protein. The blood typing laboratory tests milk samples for the presence of the kappa-casein B gene; the DNA lab tests blood and semen samples to detect the gene.
- The DNA lab introduced diagnostic services for the parentage verification of the Canadian Sheep Breeders' Association's spot test registration program.
- Processed 29,794 bovine samples in the blood typing lab, an increase of approximately 10% over the previous year.
- Research is currently being concluded to isolate two DNA fingerprinting probes for cattle parentage verification. Development of these markers will further increase the strong genetic capabilities of the lab and will allow the lab to provide diagnostic services for clients in the public and private sectors.

Publications

BOVA-CAN Parentage Testing Inc. MacKay, G. Smithson, G. Kraay, G. Plante, Y. S-803-1-E-90

Incidence of 1;29 Robertsonian Translocation in Canadian Beef Cattle. Pasitschniak-Arts, M. Kraay, G. S-803-1-B-91

Quality Control Important for Breeders. Kraay, G. S-803-2-G-91

ADVISORY BOARD

(as of March 31, 1991)

Ken Ayresworth, Gen. Manager, Canadian Charolais Assoc. (Calgary, Alta.)

Henry Begrand, President, Canadian Charolais Assoc. (St. Louis, Sask.)

Barry Bennett, Gen. Manager, Canadian Simmental Assoc. (Calgary, Alta.)

Glenn Cherry, Registrar, Holstein Association of Canada (Brantford, Ont.)

Dr. David Christensen, Head, Animal & Poultry Science,University of Saskatchewan (Saskatoon, Sask.)

Vern Davidson, President, Canadian Gelbvieh Association (Ponteix, Sask.)

Mel Gosling, Past President, Canadian Limousin Assoc. (Dalemead, Alta.)

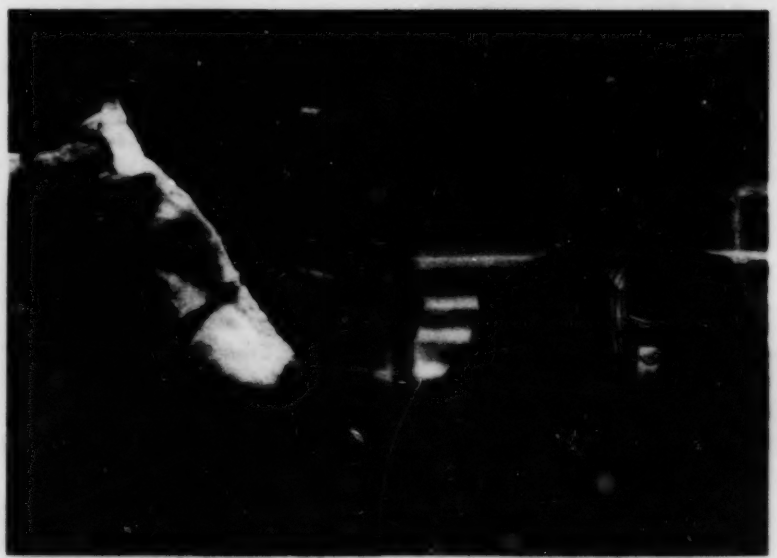
Dr. Gerry Kraay, Manager, Bovine Blood Typing Laboratory (Saskatoon, Sask.)

George MacKay, Vice President, SRC (Saskatoon, Sask.)

Allan Preston, 1st Vice President, Canadian Simmental Association (Hamiota, Man.)

Dr. Gene Smithson, Director, SRC Analytical Services Laboratory (Saskatoon, Sask.)

Harvey Tedford, Secretary-Manager, Canadian Limousin Association (Calgary, Alta.)



SRC Vice President George MacKay represented the Bovine Blood Typing Lab and PAMI at Canadian Western Agribition.

ANALYTICAL SERVICES LABORATORY

Analytical Services operates one of the largest and best equipped laboratories in Canada, providing Saskatchewan clients with the most complete array of analytical services available anywhere. Services in radiochemistry, chromatographic analysis and water and general chemistry are also provided to commercial and government clients across the country. The analysis of environmental samples for trace and major constituents is the major focus of the laboratory. However, virtually all modern analytical procedures can be performed.

The radiochemical section is recognized as one of the largest laboratories of this type in Canada. All uranium and thorium series isotopes are determined routinely, in addition to delayed neutron counting of uranium and a variety of neutron activation procedures. The laboratory has the capability to determine all man-made radioisotopes.

In the chromatography section, a wide range of herbicides, pesticides and toxic organic chemicals are routinely determined. These analyses are performed on drinking water supplies, lake and river samples, agricultural products and environmental samples.

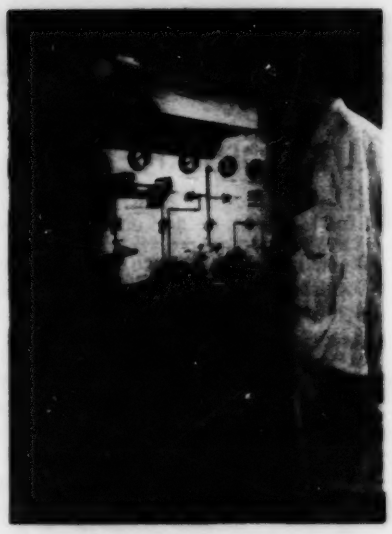
Highlights

- A transformer oil analysis laboratory has been added to measure all of the required physical parameters as well as dissolved trace gases.
- The number of Saskatchewan towns and villages having their water supplies analyzed for trace elemental and organic contaminants has increased significantly.
- Several major pieces of equipment have been added or replaced in the radiochemical section to improve service and capabilities.

Publications

Saskatchewan Research Council Slowpoke II Facility Annual Compliance Report April 1, 1989 to March 31, 1990 for Atomic Energy Control Board. Smithson, G.L. Chorney, D. S-803-2-E-90

Uranium Analysis by Instrumental Neutron Activation Analysis, Delayed Neutron Counting and Inductively Coupled Plasma - Mass Spectrometry. Smithson, G. Presented at the 73rd Chemical Conference and Exposition, 1990 CIC Congress, Halifax, N.S. July 15-20, 1990.



Research technician Jeff Zimmer uses a Benzene Synthesizer to convert carbon from samples into benzene which is then used in a liquid scintillation counter to determine the residual carbon-14. Carbon-14 dating can determine the age of a sample as far back as 30,000 years.

Staff:
Director: G. Smithson (Ph.D., P.Eng.)
M. Brenner (Chem.Tech.)
D. Chorney (Chem.Tech.)
L. Chrusch (B.Sc.)
G. Drader (Chem.Tech.)
V. Evans (Chem.Tech.)
M. Fahri (B.Sc.)
R. Fedyk (Chem.Tech.)
L. Jensen
I. Khosla
P. La (Chem.Tech.)
J. Ma (B.Sc.)
L. MacDonald
S. Martin (Chem.Tech.)
P. Moser (Chem.Tech.)
J. Ng
G. Shutiak (Chem.Tech.)
L. Simon
V. Snook (Chem.Tech.)
B. Stanek (B.Sc.)
C. Tamosiunis (Chem.Tech.)
B. Ullah (Chem.Tech.)
S. Wilkie (Chem.Tech.)
S. Woo (Chem.Tech.)
W. Yuen (Ph.D.)
J. Zimmer (Chem.Tech.)

THE SASKATCHEWAN RESEARCH COUNCIL

FINANCIAL STATEMENTS Year Ended March 31, 1991

AUDITOR'S REPORT

To the Members of the Legislative Assembly of Saskatchewan

I have audited the balance sheet of The Saskatchewan Research Council as at March 31, 1991 and the statements of operations and changes in financial position for the year then ended. These financial statements are the responsibility of the Council's management. My responsibility is to express an opinion on these financial statements based on my audit.

I conducted my audit in accordance with generally accepted auditing standards. Those standards require that I plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In my opinion, these financial statements present fairly, in all material respects, the financial position of the Council as at March 31, 1991 and the results of its operations and the changes in its financial position for the year then ended in accordance with generally accepted accounting principles.

Regina, Saskatchewan
May 10, 1991

W.K. Strelioff

W.K. Strelioff, C.A.
Provincial Auditor

Statement 1

THE SASKATCHEWAN RESEARCH COUNCIL

BALANCE SHEET

as at March 31

ASSETS	1991	1990
Current assets:		
Accounts receivable	$2,384,688	$2,577,185
Prepaid expenses	310,618	106,362
	2,695,306	2,683,547
Deferred charges (Note 3)	563,500	422,000
Fixed assets (Note 5)	3,100,473	3,244,669
	$6,359,279	$6,350,216
LIABILITIES AND PROVINCE'S EQUITY		
Current liabilities:		
Bank indebtedness (Note 4)	$3,839,768	$3,849,678
Accounts payable	481,627	538,348
Deferred revenue	542,681	614,509
Vacation and benefits payable	193,728	170,663
Retroactive salaries payable	70,000	70,000
	5,127,804	5,243,198
Non-current liabilities:		
Sick leave benefits payable	375,694	345,531
Deferred revenue	100,910	170,314
	5,604,408	5,759,043
Province's equity:		
Retained earnings (Statement 2)	754,871	591,173
	$6,359,279	$6,350,216

(See accompanying notes to the financial statements)

Statement 2

THE SASKATCHEWAN RESEARCH COUNCIL

STATEMENT OF OPERATIONS

Year Ended March 31

	1991	1990
Revenue:		
Contracts	$10,388,661	$ 9,809,241
Grants from Consolidated Fund		
- Operating	5,256,300	5,345,000
- Saskatchewan Property Management Corporation	2,127,700	2,859,800
	17,772,661	18,014,041
Expense:		
Salaries and benefits	9,619,260	9,187,805
Supplies and services	4,677,182	4,490,389
Depreciation	1,009,841	1,008,171
Bank interest	228,693	343,109
Accommodation charges (Note 7)	2,073,987	2,859,800
	17,608,963	17,889,274
Net income	163,698	124,767
Retained Earnings, beginning of year	591,173	466,406
Retained Earnings, end of year - to Statement 1	$ 754,871	$ 591,173

(See accompanying notes to the financial statements)

Statement 3

THE SASKATCHEWAN RESEARCH COUNCIL

STATEMENT OF CHANGES IN FINANCIAL POSITION

Year Ended March 31

	1991	1990
Cash provided by (used in):		
Operating Activities:		
Net income	$ 163,698	$ 124,767
Add (deduct) items not affecting cash:		
Depreciation	1,009,841	1,008,171
Amortization of deferred revenue	(614,509)	(413,791)
Loss (gain) on disposal of fixed assets	13,199	(12,059)
Increase in deferred charges	(141,500)	(105,131)
Increase in sick leave benefits payable	30,163	24,733
	460,892	626,690
Net change in non-cash working capital balances related to operations (Note 6)	427,862	(829,401)
Cash provided by (used in) operating activities	888,754	(202,711)
Investment Activities:		
Purchase of fixed assets	(878,844)	(944,848)
Proceeds from sale of fixed assets	—	86,975
Cash used in investment activities	(878,844)	(857,873)
Increase (decrease) in cash position	9,910	(1,060,584)
Bank indebtedness, beginning of year	(3,849,678)	(2,789,094)
Bank indebtedness, end of year	$(3,839,768)	$(3,849,678)

(See accompanying notes to the financial statements)

NOTES TO THE FINANCIAL STATEMENTS

1. Status of The Saskatchewan Research Council

The Saskatchewan Research Council was established pursuant to Section 3 of The Research Council Act for the purpose of research and investigation in the fields of the physical sciences, pure and applied, as they affect the economy of the Province of Saskatchewan. The Council is a body corporate which receives monies appropriated by the Legislature for these purposes. It is also empowered to conduct research under contract for others and to receive financial assistance pursuant to agreements with other similar agencies.

2. Summary of Accounting Policies

The financial statements are prepared on the accrual basis of accounting using the following accounting policies.

a) Revenue Recognition

Revenue from the majority of contract work is recognized on the percentage-of-completion method which recognizes revenue as a contract progresses. Unbilled revenues are accrued to the year end for these contracts, while pre-billed revenues received are classified as deferred revenue.

b) Fixed Assets

The assets of the Council are initially recorded at cost, including labour, material and overhead for self-constructed assets.

Depreciation is provided over the estimated useful lives of the assets on the following basis:

i) Sum-of-the-years'-digits method	
Buildings	20 years
Leasehold improvements	5 years
Equipment	10 years
ii) Declining balance method	
Automotive	33 1/3%

c) Pension Costs

The Council participates with its employees in a pension plan. Until December 31, 1990, it was a defined benefit plan. Effective January 1,1991, the plan was changed to a defined contribution plan. In addition, the plan now requires contributions from the employer only. The changes do not affect existing pensioners who will continue to receive benefits granted.

To December 31, 1990 pension costs were determined using the accrued benefit actuarial cost method. This cost reflects estimated salary increases, mortality of members, terminations and the ages at which members will retire. Adjustments arising from plan amendments, experience gains and losses and changes in assumptions were amortized over the estimated average remaining service lives of employees. After December 31, 1990, pension costs will also include amounts SRC is required to remit to the plan for current service.

d) Accrued Vacation Credits

The costs associated with vacation credits are recognized when the vacation entitlements are earned. The value of credits plus associated employee benefit costs earned to the year end but not taken are reflected as a liability.

e) Sick Leave Benefits

The Council allows unused sick leave credits to accumulate over the term of employment for each employee and pays out 10% of the unused accumulated sick leave based on the wage rate in effect at the time of termination of employment. The costs associated with these sick leave benefits are recognized when benefits are earned and accumulated by employees at a rate of 10% of the unused accumulated value of credits earned.

3. Pension Plan

An actuarial valuation was performed as at January 1, 1991. It indicated that using the accrued benefit actuarial cost method, the present value of accumulated benefits resulting from services provided to the valuation date was $14,493,939. It also stated that the value of pension fund assets was $15,298,331 based on quoted market values. The resulting net actuarial surplus was stated to be $804,392.

Deferred charges at year end resulted from amounts paid to the Pension Plan as recommended by the actuary in excess of pesion expenses determined in accordance with CICA Handbook section 3460. As a result of changes made to the Plan on January 1, 1991, this balance is being amortized over the average remaining service life of the active Plan members.

4. Bank Indebtedness

The Saskatchewan Research Council was authorized to establish a line of credit not to exceed $5,100,000. There is an assignment of the accounts receivable as collateral for bank indebtedness.

5. Fixed Assets

	1991			1990
	Cost	Accumulated Depreciation	Net Book Value	Net Book Value
Buildings	$ 710,636	$ 576,820	$ 133,816	$ 162,451
Leaseholds	646,296	637,570	8,726	30,831
Equipment	10,135,889	7,191,418	2,944,471	3,036,697
Automotive	204,620	202,160	2,460	3,690
Land	11,000	—	11,000	11,000
	$11,708,441	$8,607,968	$3,100,473	$3,244,669

6. Statement of Changes in Financial Position

The net change in non-cash working capital balances related to operations is comprised of the following:

	1991	1990
Decrease in accounts receivable	$192,497	$ 364,060
Increase in prepaid expenses	(204,256)	(11,142)
Increase (decrease) in accounts payable	(56,721)	(1,630,768)
Increase in deferred revenue	473,277	474,534
Increase (decrease) in vacation and benefits	23,065	(6,085)
Decrease in retroactive salaries	—	(20,000)
	$427,862	$(829,401)

7. Related Party Transactions

Related parties to the Council are Saskatchewan's Crown-controlled departments, agencies and corporations. Transactions with these parties are recorded at normal market prices except for the following.

During the year, the Council paid $2.1 million to the Saskatchewan Property Management Corporation for accommodation charges on buildings.